THE DANISH
NATIONAL CENTRE
FOR SOCIAL RESEARCH

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01:2010 WORKING PAPER

# DOES THE CAUSAL EFFECT OF HEALTH ON EMPLOYMENT DIFFER FOR IMMIGRANTS AND NATIVES?

RESEARCH DEPARTMENT OF EMPLOYMENT AND INTEGRATION

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**Abstract**

This paper examines whether a causal effect of health on employment exists and, if so, whether it differs for immigrants and natives and whether such a difference can be attributed to different labour market status. Measuring poor health through information about hospital diagnoses for a number of specific diseases, we estimate bivariate probit models using the general practitioner's referral behaviour as an instrument for receiving diagnoses. Using Danish administrative data, we find that poor health affects the employment probability negatively for both immigrants and native Danes. For men, the impact of health is largest for immigrants, while for women the effect is very similar. Differences in the distribution of lagged labour market status appear important only in explaining the results for women.

**Keywords**: Immigrants, objective health, employment, causality, administrative data.
**JEL-classification**: I0, J15, J21.

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¥ We thank Steven Jenkins, Nabanita Datta Gupta, Vibeke Myrup Jensen and Paul Bingley, conference participants at ESPE and participants at numerous workshops for comments on previous versions of this paper. We also thank the Danish Ministry of Employment for providing financial support.

# Contents

## 1. Introduction

In most European countries, immigrants' employment rates are considerably lower than those of the native population (OECD, 2005 and 2008), suggesting relatively smaller tax revenues and higher public expenditures along with a systematic skewness in the income distribution with respect to ethnicity. While previous studies show that well-known human capital factors such as education, language skills and years since migration contribute to explaining differences in employment rates between immigrants and natives (see, e.g. Hummelgaard et al., 2002; Nekby, 2002; Zorlu and Hartog, 2002), these factors do not explain the entire difference. Even though wide recognition that health is a major determinant of labour market outcomes (see, e.g. Currie and Madrian, 1999), only a few studies focus on the relationship between health and labour market status for immigrants, and these studies are generally based on simple correlations between health and employment.

The first purpose of this paper is to examine whether the causal effect of health on employment status differs for immigrants and natives. The effect of health for immigrants and natives may differ for at least three reasons: cultural differences, different labour market status and discrimination (we develop these explanations in section 2). Our data enable us to look at the importance of different labour market status. Therefore, the second purpose is to explore whether differences in the distribution of labour market status helps explain the potential differences in the impact of health. For these purposes, we use Danish data and compare the causal impact of health on the employment probability for non-Western immigrants and native Danes (section 4 defines these two groups more precisely).

Identifying the causal effect of health on employment is a challenge due to potential endogeneity of health status and potential reverse causality between health and labour market attainment. Further, to capture the causal effect we need a good measure of true (and objective) health. The approach in this paper is the use of an objective measure for health based on administrative register data from Statistics Denmark. Health is measured with information about hospital diagnoses for a number of specific diseases that are not only among the most widespread in Denmark but also to some extent preventable (Danish Government, 2002). If differences in the impact of these diseases partly explain the employment gap between immigrants and natives, an effort toward preventing the selected diseases could be one way of reducing this gap.

To solve the potential problem of endogeneity, we apply a two-stage method and use information about the general practitioner's (GP) referral behaviour as an instrument for receiving diagnoses. In Denmark, as in many other countries, GPs act as gatekeepers to hospitals: an individual cannot be hospitalised without a referral from his or her GP (except for emergencies). A GP's referral, not a patient's economic status, is the determining criteria, because health care in Denmark is universal, and access to (most) public health services is free.[1] The GP's role as gatekeeper, together with the universal health insurance system, makes the GP's referral behaviour useful as an instrument for hospital diagnoses in Denmark.

Working with Danish data is useful for a number of reasons. First, we have access to a rich longitudinal dataset for the period 1995-2006, including annual information about hospital diagnoses and GP behaviour, together with a wide set of demographic and labour market characteristics. Second, the samples we apply for our main analyses comprise the total population of immigrants and a 5% representative sample of the native Danish population. Large sample size is particularly important in this context, given the relatively small number of immigrants of working age and the low incidence of selected diagnoses. Third, by using register data we avoid biases from sample selection (see, e.g. Groves and Couper, 1998) and from self-reports of health (see, e.g. Bound, 1991; Bound and Burkhauser, 1999; Lindeboom and Van Doorslaer, 2004) – both of which are frequent in survey data. Fourth, by using Danish data we avoid biased results arising from differences in (formal) access to health care as would be the case for corresponding estimations for countries such as the US (see, e.g. Chandra and Skinner, 2004).

The main contribution of this paper is to estimate the causal effect of health on employment status, for the first time providing comparable estimates for immigrants and natives. Further, by conducting separate estimations for men and women, the paper contributes to the scarce literature on gender differences in the effect of health on labour market outcomes. Finally, by introducing a new instrument for hospital diagnoses (GP's referral behaviour), the paper makes an important contribution to the literature on how to estimate the causal effect of health.

The findings show that poor health affects the employment probability negatively for both immigrants and native Danes. For men, the impact of health is largest for immigrants, while the effect is very similar for women. The results suggest that differences in the distribution of lagged labour market status are important in explaining differences in the impact for women, while discrimination might be a more essential explanation for men.

This paper is organised as follows. Section 1.1 briefly introduces to the Danish health and labour context. Section 2 describes the theoretical background and previous research on the effect

[1] For a description of the Danish health care system, see Vallgårda et al., 2001.

of poor health on labour market outcomes. Sections 3 and 4 explain the empirical model and the data, respectively. Section 5 contains the results and Section 6 concludes.

### *1.1 The Danish health and labour context*

The composition of immigrants and the health and labour context in the host country affect the extent to which the causal effect of health on employment status differs for immigrants and natives. Previous studies show that economic immigrants fare better in host country labour markets than refugees and immigrants who have immigrated for family reunification (see, e.g. Chiswick et al., 2005; Husted et al., 2001). Few non-Western immigrants in Denmark are purely economic immigrants as most are refugees or have immigrated for family reunification.

As a consequence of an economic boom and the resultant labour shortages in the late 1960s, Denmark began recruiting guest workers. These workers, mostly men from Turkey, Pakistan and the former Yugoslavia, immigrated to Denmark primarily to work as unskilled workers in the manufacturing industry. When the full employment period ended in 1973, immigration was brought to a halt by statutory intervention, leaving only two major channels of legal immigration from non-Western countries: family reunification and asylum (Bauer et al. 2004). Many of the guest workers stayed in Denmark and brought their families to the country; moreover, many of their children chose spouses from the country of origin (Schmidt and Jakobsen, 2000). Family reunification thus increased significantly in the 1970s and has since been an important source of immigration. The number of refugees increased greatly in the 1980s and 1990s (Bauer et al., 2004), with some of the largest groups from Iran, Lebanon, Iraq, Somalia and Bosnia-Herzegovina. The number of non-Western immigrants was 237,695 in 2008 (4.3% of the total population) compared to only 46,610 in 1980 (0.9% of the population).

Non-Western immigrants fare worse than native Danes in terms of education and labour market status: they are less educated than native Danes (see, e.g. Jakobsen, 2008) and have lower employment rates. In 2008, employment rates were 82% and 77% for native Danish men and women respectively, compared to 63% and 50% for non-Western immigrant men and women (Statistics Denmark, 2009). The low employment rates are partly explained by a combination of fairly high minimum wages in the Danish labour market[2] and the low educational level among the

[2] Rather than having a legal minimum wage, Denmark has minimum wages covered by collective (union and employer) agreements.

non-Western immigrants. The low educational level also helps explain why non-Western immigrants are overrepresented at the bottom of the job hierarchy (see, e.g. Jakobsen, 2008).

The Danish welfare state is based on universal, tax-financed social benefits and rights to free social services, health care and education for all individuals resident in Denmark (Torfing, 1999). Further, a low level of job protection is combined with relatively generous social benefits (the ‘flexicurity model’ (Kongshøj Madsen, 2005). The generous benefits enable many low-paid workers to maintain a reasonable standard of living even if they lose their jobs due to unemployment or illness (Kongshøj Madsen, 2005). If such benefits reduce the incentives for long-term sicklisted workers to search for a job or return to work, the period out of work following a diagnosis might be protracted. Consequently, given immigrants’ low employment rates, their low education and their overrepresentation at the bottom of the job hierarchy, the Danish institutional setting might make the impact of poor health on employment probabilities greater for this group.

## 2. Theoretical considerations and previous research

In models for labour market assimilation of immigrants, a variable describing the number of years since migration is typically added as an explanatory variable to the standard Mincer wage function and the corresponding model for employment. Thus the human capital approach predicts a weak attachment to the labour market for immigrants in the period right after arrival to the host country due to lack of country-specific human capital (e.g. language proficiency and common knowledge of the labour market in the host country). After some time in the host country, immigrants acquire human capital specific to the host country, thereby improving their labour market situation (Chiswick, 1978). In accordance with this prediction, several studies have shown that occupational status, wage rates and the probability of being employed increase with the years following migration (see, e.g. Chiswick et al., 1997; Husted et al., 2001).

Health is also considered as human capital, analogous to other types of human capital such as education, and the stock of health depends on the initial health stock, past investments in health, and the rate of depreciation of health capital (Grossman, 1972). Better health implies higher productivity, thereby leading to a higher probability of labour force participation and higher wages. Thus labour supply and wages depend on health (Currie and Madrian, 1999). Moreover, health problems may reduce labour market activity through changes in the individual’s relative utility derived from income and time out of the labour market. For example, poor health may increase the time needed for caring for one’s health, thereby increasing the value of time out of the labour market (Cai and Kalb, 2006). Another potential explanation of the relationship between health and labour market outcomes is discrimination, as those with poor health may be subject to discrimination (Currie and Madrian, 1999).

The effect of health on wages and employment is often estimated by adding health as an explanatory variable to the standard Mincerian wage function and a corresponding model for employment. However, health must be treated as endogenous when we estimates its effect on labour supply and wages (Currie and Madrian, 1999). First, the human capital model implies that investments in health depend on the return to health and thereby on wages and employment possibilities. Second, there may be a direct effect of wages and labour market activities on health. For example, deterioration of health might arise through non-participation leading to boredom or general lack of activity or through stressful or physically demanding jobs (see, e.g. Cai and Kalb, 2006; Currie and Madrian, 1999).

The empirical literature suggests that poor health has substantive effects on labour market outcomes (wages, working hours and labour force participation). However, the magnitudes of these effects are sensitive to the choice of health measure and the identifying assumptions (Currie and Madrian, 1999). Furthermore, previous studies on the relationship between health and labour market outcomes have mainly focused on elderly white men and excluded other groups from the analyses (Pelowski and Berger, 2004; Currie and Madrian, 1999). Therefore, empirical studies on the importance of gender, ethnicity and immigrant status in the return to health is scarce.

However, a few studies compare men and women and find gender differences in the impact of poor health on labour market outcomes, e.g., Pelowski and Berger (2004) show that a permanent health condition reduces the wages for both men and women but that the reduction is largest for women while reducing hours of work significantly only for men. Cai and Kalb (2006) show that better health increases the probability of labour force participation mostly for women. Further, Bound et al. (2003) examine the impact of health for different ethnic groups and find that the effect of poor health on employment status is slightly more negative for African Americans and Native Americans than for non-Hispanic Caucasians in the US. Finally, studies based on self-rated health measures show a positive correlation for immigrants between good health and both labour market attachment (Møller and Rosdahl, 2006) and their employment probability (Schultz-Nielsen, 2002). However, among these studies, only Cai and Kalb (2006) take potential endogeneity into account.

Why do we expect health effects on labour market outcomes to differ between immigrants and natives? At least three explanations of these differences are possible: (1) cultural differences, (2) different status in the labour market and (3) discrimination. These explanations also help explain potential gender differences in the impact of health, thereby serving as an argument for comparing immigrants and natives separately for men and women.

First, cultural differences may exist in the perception of how much a given disease reduces working capacity. Previous research shows that immigrants assess a given chronic disease as reducing their working capacity more than natives do (Blom and Ramm, 1998). However, such a different assessment might also reflect differences in the severity of the disease between the two groups or be related to immigrants having different kinds of jobs than natives, jobs in which working with a chronic disease is more difficult. Moreover, the relative utility derived from labour market activities and from time out of the labour market may also differ for different groups. For example, in some more gender traditional families, men are supposed to be the breadwinners, and therefore employment is more important for men. In these families, men might be less inclined to reduce labour market activities for health problems than their wives would. Such traditional views of gender roles are more prevalent among immigrants than among native Danes (Deding and Jakobsen, 2008). Consequently, immigrant men might be less willing to reduce their working hours than native Danish men (other things being equal), while the opposite holds for women.

Second, differential distribution of labour market status may also lead to differential effects of poor health on labour market outcomes for immigrants and native Danes. For example, the ratio of unemployment or sickness benefits to previous labour income is likely to be higher for those in low-skilled jobs than for those in high-skilled jobs. Therefore, economic incentives to search for or retain a job are lowest for workers with poor health if they are on the low-skilled job market. Furthermore, physical job demands differ among segments of the labour market. In Denmark, immigrants are overrepresented in unskilled jobs at the bottom of the job hierarchy and underrepresented among managers, professionals and technicians (Schultz-Nielsen and Constant 2004; Jakobsen 2008).

Gender differences exist in the distribution of labour market status for both immigrants and native Danes (Emerek and Holt, 2008; Jakobsen, 2008), potentially implying that the impact of poor health on labour market status also differs by gender. Native Danish women are underrepresented at both the top and the bottom of the job hierarchy compared to Native Danish men, while immigrant women are overrepresented at the bottom of the job hierarchy, compared to immigrant men.

Third, immigrants generally experience more discrimination in the labour market than natives do (Carlsson and Rooth, 2007; Hjarnø and Jensen, 1997). As a consequence, immigrants might have to be better qualified to find and retain a job. Therefore, discrimination may lead to an even smaller employment probability for immigrants with poor health. In general, women experience more discrimination, suggesting that immigrant women are doubly affected by discrimination. However, previous studies show that the opposite gender difference exists for immigrants: immigrant men experience more discrimination than immigrant women (Møller and Togeby, 1999; Lange, 1999; Drøpping and Kavli, 2002). Therefore, discrimination may contribute to larger negative effects of health on employment for immigrant men.

Given differential labour market status and discrimination, we expect in general that the impact of health is greater for immigrants than for native Danes. The impact of cultural differences is less clear, e.g. the importance of differences in the perception of the extent to which a given disease reduces working capacity. However, we expect that immigrants' more traditional view of gender roles leads to a greater impact of health on employment for immigrant women than for native Danish women, and the same or a smaller impact for immigrant men than for native Danish men.

Within the group of immigrants, differences might arise from such factors as differences in attitudes, labour market attachment and degree of discrimination. Hence, the prevalence of traditional views of gender roles, discrimination, etc. differs for different groups of immigrants (Deding and Jakobsen, 2008; Møller and Togeby, 1999).

## 3. Empirical model

Unobserved factors affect both employment status and health, thereby potentially leading to omitted variable bias. In addition, reverse causality might be an issue. Reverse causality might arise because poor health typically is related to lifestyle factors potentially associated with the employment status of the individual. To look for causal relationships in empirical studies of the impact of health on labour market outcomes, researchers have typically focused on health shocks or accidents (see, e.g. Riphahn, 1999; Coile, 2004; Lindeboom et al., 2007) or instrumented health (see, e.g. Dwyer and Mitchell, 1999; Ettner et al., 1997). We follow the latter strategy.

We estimate two models, namely a univariate and a bivariate probit model. In the latter model, we instrument health to take potentially endogeneity of health into account. We prefer a probit specification to a linear model, as Bhattacharya et al. (2006) and Monfardini and Radice (2008) show that the bivariate probit model is the preferred specification when both dependent variables in a IV regression are dummy variables as is the case in our analyses (see section 3.2).[3] We conduct separate estimations for four groups: immigrant men, immigrant women, native Danish men and native Danish women. We compare immigrants and natives separately for men and women because we expect the effect of health on employment to differ by gender (see section 2).

We include immigrants and native Danes in the analyses irrespective of labour market status (see also section 4). Therefore, the group of 'not employed' also includes – in addition to the unemployed – individuals outside the labour force. We include the latter to avoid sample selection bias, because the labour force participation rates for our samples of immigrants and native Danes greatly differ (see section 5.2). To reduce the degree of heterogeneity, we conduct the estimations for individuals aged 25-59. Thus, by skipping individuals below the age of 25 or above the age of 59, we limit the share of early retirees and individuals engaged in full-time education. However, the composition of the 25-59-year-old non-Western immigrants and native Danes with respect to previous labour market status differs, potentially implying differences in the effect of health on the employment probability (see section 2). Therefore, to explore whether this difference in the distribution of lagged labour market status contributes to explaining our results, we calculate marginal effects for each labour market status category.

### *3.1 The univariate probit model*

We estimate probability models of being employed on samples pooled over years in which the latent variable $E^*_{it+1}$ is the unobserved propensity to be employed at time period t+1 and is given by:

$$E^*_{it+1} = \beta_0 + \beta_d D_{it} + \beta'_X X_{it} + \mu_{0it}, \ for \quad i = 1 \ldots N, t = 1 \ldots T_i$$

$$E_{it+1} = \begin{cases} 1 \ if \ E^*_{it+1} > 0 \\ 0 \ else \end{cases}$$

$$E[\mu_0] = 0$$

$$Var[\mu_0] = 1$$

$E_{t+1}$ is the observed employment probability at time $t+1$, $D_t$ measures occurrence of a diagnosis at time $t$, $X_t$ is a vector of controls measured at time $t$ including age, family factors,

[3] We also conducted our estimations using a linear model. However, the results for immigrants show that using a linear or a probit model makes a difference (we get significantly larger estimates when applying a linear model).

education and year dummies. Information on years since migration and country of origin are included only for immigrants, thereby taking into account unobserved country differences in, for example, the degree of discrimination. For a detailed description of the included variables, see Section 4.

### *3.2 The bivariate probit model*

By using the univariate probit model, we assume that our health measure conditional on covariates is independent of employment probability. To solve problems of potential endogeneity, we use an IV regression method based on a recursive bivariate probit model:

$$E*_{it+1} = \beta_0 + \beta_d D_{it} + \beta'_X X_{it} + \mu_{1it}, \; for \;\; i = 1 \ldots N, t = 1 \ldots T_i$$

$$D*_{it} = \beta_0 + \beta_z Z_{it-1} + \beta'_X X_{it} + \beta'_p P_{it-1} + \mu_{2it}, \; for \; i = 1 \ldots N, t = 1 \ldots T_i$$

$$E_{it+1} = \begin{cases} 1 \, if \;\; E*_{it+1} > 0 \\ 0 \; else \end{cases}$$

$$D_{it} = \begin{cases} 1 \, if \;\; D*_{it} > 0 \\ 0 \; else \end{cases}$$

$$E[\mu_1] = E[\mu_2] = 0$$

$$Var[\mu_1] = Var[\mu_2] = 1$$

$$Cov[\mu_{1,} \mu_2] = \rho$$

The latent variable $D_{it}$ is the observed propensity to have a diagnosis at time *t* and $Z_{it-1}$ is the instrument (measured at time t-1), that is a variable correlated with $D_t$ but uncorrelated with the error term in the employment equation, $\mu_1$. $Z_{it-1}$ is referral behaviour of individuals' GP. In addition to the control variables included in the employment equation, the health equation also includes a vector of controls measured at time *t-1*, $P_{it-1}$, including characteristics of the individual's general practitioner's (GP) patients. Given a valid instrument, a non-zero correlation between the error terms $\mu_1$ and $\mu_2$ ($\rho$) shows that health status and employment are endogenous. If so, we prefer the bivariate probit model. If not, we choose the univariate probit model as the preferred specification.

We use information about the GP's referral behaviour because GPs act as gatekeepers to hospitals.[4] Hence, patients can not be hospitalised without a referral from a GP except in acute situations where patients can be admitted via the hospital emergency room. The GP role as gatekeeper, together with the universal health insurance system, makes GP referral behaviour useful as an instrument for hospital diagnoses in Denmark. By using this instrument, we exploit exogenous variation in that some GPs are more likely than others to refer their patients to hospitals so that their patients get diagnosed more. Indeed, previous studies show that GPs' propensity to refer patients to hospitals differ widely (see, e.g. Scott, 2000). Such behavioural variation might be the result of differences in non-clinical factors such as the GP's own objectives and preferences, knowledge, experience and uncertainty (Scott, 2000).

The variation in GP referral behaviour suggests that similar patients with the same disease of the same severity have access to potentially different treatment. Therefore, the health measure we use (hospital diagnoses) is a combination of (1) unobserved 'true' health, (2) patient health behaviour such as frequency of GP visits and (3) health care provision, including referrals. Patient health behaviour might correlate with the employment status of the individual, thereby producing a spurious link between this behaviour and our observed health measure (hospital diagnoses). By applying the GP's referral behaviour as an instrument for hospital diagnoses, we break this potential link, thus providing exogenous variation in access to hospitals. Therefore, we find it reasonable to assume that by using this instrument we obtain a clean objective health measure.

GP behaviour provides a credible exclusion restriction because it is unlikely that GP behaviour has a direct effect on employment or has any effect other than via the channel of health care provision. However, correlation between the instrument and employment might arise if the propensity to go to a GP differs depending on whether an individual is working or not, because a diagnosis is only made if an individual consults his or her GP. Some might argue that those out of work have more time off, so that if they utilize the health care system more often, they receive more diagnoses. The instrument and employment might also correlate if the employment status of an individual leads him or her to a persistently change GP until he or she finds one willing to refer him

[4] In some previous studies, information on e.g. the health status of parents has been used as instrument (see, e.g. Dwyer and Mitchell, 1999; Ettner et al., 1997). However, since our data include information only on parents who are living in Denmark, parent health is not useful as an instrument for immigrants in this study.

or her to a hospital. An individual with a physically demanding job, for example, might exhibit this kind of behaviour if he or she prefers to stop working and to replace wages with sickness benefits.

In this paper, however, to be classified as ‘diagnosed’ means that an individual has to (1) be referred to the hospital by his or her GP and (2) be hospitalized and obtain from a hospital physician a diagnosis potentially different from that made by the GP (action diagnosis vs. referral diagnosis, see section 4.1). Consequently, frequent GP consults or persistent changing of GPs is not sufficient for being classified as ‘diagnosed’. However, as a correlation between a GP’s referral behaviour and a individual’s employment status might still exist, we therefore control for heterogeneity in the individual’s incentives to work by including controls for education and age in the employment equation. Given that we are able to sufficiently control for the individual’s incentive to work, these incentives are not a component in the error term in the employment equation and do not give rise to correlation between the GP’s referral behaviour and the error term.

Exogenous variation in the GP’s referral behaviour also requires that the patients randomly select their GP. We assume that this condition is fulfilled because in Denmark people are assigned their GPs by area of residence. However, the location of the population is not random, so some GPs might have less healthy patients than others. Consequently, the share of patients referred to hospitals may reflect not only differences in the propensity to refer but also differences in the composition of patients. To take the latter into account, we use the composition of patients with respect to income, gender, age and immigrant status as proxies for patients’ health in the health equation. We use information on the GPs (the instrument and the variables for the composition of patients) for time period t-1 to ensure that these variables are truly uncorrelated with the patients’ health behaviour. In addition, we adjust standard errors for multiple observations on GPs by clustering.[5]

The local average treatment effect (LATE), which we estimate by using a bivariate probit model, is the average impact of diagnoses on employment for those individuals who were diagnosed only because they consulted with a GP who had a higher referral rate. Hence, given that GPs refer patients with the most severe symptoms to hospitals, using the referral rate as an instrument leads to estimation of the impact of health for less severe cases, and thereby to estimation of a lower bound of the impact of health on employment.

[5] For all four groups, the number of clusters is 2,600-2,700.

## 4. Data and descriptives

We use longitudinal administrative register data from Statistics Denmark for the period 1995-2006, including information on the total population of non-Western immigrants and a 10% representative sample of the population of native Danes. For all these individuals, we have information about their parents, spouses, family members and all others living in the same household. Consequently, we have information on about three million individuals each year, a figure corresponding to about half of the population of Denmark. The estimations are based on the total population of non-Western immigrants and half of the 10% sample of native Danes in the age group 25-59. Thus, we use samples of about the same size for immigrants and native Danes in our main estimations. However, we use information about all available individuals in our data, irrespective of age, to construct lagged GP related variables, thereby minimizing the correlations between the health behaviour of individuals in our main sample and the constructed GP related variables. To construct the GP related variables, we use a GP identifier to link individuals with their GP.

The definition of immigrants and native Danes is based on Statistics Denmark's classification of the population into three groups: immigrants, descendents of immigrants and native Danes (Poulsen and Lange 1998).[6] Immigrants are defined as foreign-born individuals with foreign-born parents or parents with foreign citizenship. Descendents of immigrants are defined as individuals born in Denmark to foreign-born parents or parents with foreign citizenship. Native Danes are defined as individuals born in Denmark and having at least one parent who is not only a Danish citizen but was also born in Denmark.

### *4.1 Variables*

The outcome variable is a dummy for being employed or not. We apply information about employment measured by the end of November. Subsequently, we measure employment at time t+1 to ensure that the measurement of diagnoses at time t takes place before measuring employment.

To construct a measure for poor health, we apply objective medical diagnoses made at the time of hospital discharge from the Danish National Patient Registry. Our data includes information about all the diagnoses that each individual has had during the entire year. During each hospitalization, a patient typically receives a referral diagnosis, an action diagnosis (the most

[6] Descendants are not included in our analyses because relatively few descendants originating in non-Western countries fulfil the age criteria (25-59 years old) in the period under study. Further, the descendants' employment situation is much closer to that of native Danes than that for immigrants.

important reason for the implemented medical examination and treatment), and occasionally a bi-diagnosis. In this study, we consider only action diagnoses. We focus on the following conditions: cardiovascular diseases, type 2 diabetes, preventable cancer[7], diabetes, chronic lung diseases, osteoporosis, and diseases of the musculoskeletal system. One of the reasons for selecting these diseases is that they are among the most widespread diseases in Denmark. Although allergy and the psychiatric diseases depression and schizophrenia are also very widespread, we do not examine their impact because precise information on them is not available in our data. Diagnoses related to the selected conditions are classified according to the International Statistical Classification of Diseases and Related Health Problems ICD-10.[8] Our health measure is a dummy variable for having at least one of the six diagnoses during a year.[9]

To avoid comparing individuals diagnosed for a specific condition several times during the previous years with those diagnosed for the first time, we examine only the impact of 'new' diagnoses. Hence, we restrict our samples to individuals not hospitalized during the previous two years from one of the six diagnoses in question.

To control for age, education and family factors, we include age dummies, dummies for educational category levels, and dummies for whether an individual is partnered or not and whether an individual has children aged 0-6 years.[10] To capture changes in the period under study such as business cycles, we include year dummies. For immigrants, we add additional background information by including continuous variables for years since migration and year since migration squared, and dummy variables for country of origin.

Finally, to construct the lagged variables for GP's referral behaviour and for the composition of the GP's patients, we use GP information from the National Health Service Statistics. We measure the GP's referral rate as the share of the GP's own patients that has been referred to a hospital during a year. The lagged variables refer to the values in year t-1 for the individual's GP in year t. To control for patients' composition, we include continuous variables for the average of the patients' log gross income and of the shares of female patients, patients above the age of 50, and patients being non-Western immigrants.

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[7] The selected cancer diagnoses are preventable in the sense that their emergence probably is related to lifestyle factors such as smoking.
[8] For the codes we apply to measure each diagnosis, see the National Board of Health (2006, p. 11).
[9] Less than 0.5% in our data have more than one of the six diagnoses at the same time and therefore, a variable for the sum of diagnoses is not useful in this context.
[10] Replacing this dummy variable with a dummy for children aged 0-17 produces similar results.

*4.2 Selection of the sample used for estimations*

As a consequence of using yearly information about diagnoses, we restrict the samples of immigrants and native Danes to individuals staying in Denmark for the whole year. Moreover, to be able to drop individuals with specific diagnoses within the previous two years, we restrict the samples to individuals living in Denmark within the two years before year t where diagnoses are measured (year t-1 and t-2). Finally, since employment is measured the year after the diagnosis, the samples are restricted to individuals living in Denmark in year t+1. These restrictions leave us with a sample consisting of individuals residing in Denmark for the entire year for four consecutive years. For the number of observations after making these restrictions, see the full sample in Table A.1 in the Appendix.

To be able to conduct bivariate probit analyses, we need information about the individuals' general practitioner (GP). However, the GP identifier for an individual is available for a particular year only if the individual has consulted his or her GP during that year. These consultations have taken place for the majority of the individuals, particularly women. However, for those not consulting their GP in year t, we are able to identify the GP in a number of cases by including information about year t+1 or year t-1. If the GP has been consulted in one of these years and the municipality the patients live in is the same for this year as for year t, information about the patients' GP is imputed for year t. After imputing GP information wherever possible, we are left with 91% of the full sample for the immigrant men, 88% of the full sample for native Danish men, and 96% of the full sample for the immigrant and native Danish women (see table A.1). Finally, we restrict the samples to individuals who have had the diagnosis in question in neither year t-1 nor year t-2. Table A.1 shows that this restriction leaves us with 84% of the full sample for immigrant men, 82% for native Danish men, 90% for immigrant women, and 91% for native Danish women.[11]

A comparison of probit estimates shows that that excluding individuals with lack of (imputed) information about their GP does not affect the results significantly for any of the four groups.[12] Therefore, we conduct both the probit and the bivariate probit analyses on samples for which individuals without (imputed) information about their GP are excluded.

[11] Without imputing GP information, we are left with 71% of the full sample for immigrant men, 65% for native Danish men, 84% for immigrant women, and 83% for native Danish women.

[12] Probit results for samples including individuals with lack of information about their GP are not included but are available from the authors on request.

*4.3 Descriptives*

As expected, the characteristics of immigrants and native Danes differ to a large extent (table 1). Native Danes are employed to a much larger extent than immigrants: 87% and 83% of native Danish men and women, respectively, are employed at time t+1 compared to 60% and 45% for non-Western immigrants. Looking at our main explanatory variable, we find that the incidence of the selected diagnoses is quite low, i.e. less than 4% overall. Further, the table shows that for both immigrant men and immigrant women the incidence is higher than among their native Danish counterparts. While this result is in accordance with other Scandinavian studies based on self-reported health measures (see, e.g. Syed et al, 2006; Hansen and Kjøller, 2007), it stands in contrast to studies from countries such as the US and Canada (with their larger histories of immigration), which typically find either that the immigrant-native health gap does not exist or that immigrants are healthier than natives (see, e.g. Antecol and Bedard, 2006; McDonald and Kennedy, 2004). The mixed results may arise from country differences with respect to the selection of immigrants (see Chiswick et al., 2008).[13]

Turning to the control variables, we find that immigrants are younger than native Danes, thereby emphasizing that the selected diagnoses are most widespread among immigrants. The immigrants also have children aged 0-6 years to a higher degree than native Danes, a finding potentially explained by the larger proportion of immigrants aged 25-39 years. Unfortunately, we lack information about education for almost half of the immigrants in our sample and therefore include a dummy for missing education. Among those for whom we have information, the educational level is lower for immigrants.[14] As expected, the share of immigrants increases during our observation period, while the share of native Danes remains fairly constant. The dummies for country of origin show that the largest group of immigrants is from Turkey. Finally, the lagged GP's referral rate is quite stable across ethnic and gender groups, around 13-14%, suggesting that no systematic difference exists between the four groups in the GP's average propensity to refer their patients to hospitals.

[13] The differences between native Danes and immigrants with respect to mean values for the diagnosis variable is significant at a 1% level.

[14] The administrative registers include information on education obtained in Denmark and in some cases also on education obtained in a foreign country. To supplement the register information on Danish education, Statistics Denmark has used surveys to collect information on foreign education. Nevertheless, for a large proportion of the immigrants, information on foreign education is missing (see also Mørkeberg, 2000).

**Table 1. Summary Statistics by ethnic group and gender. Mean values.**

| | Men | | | | Women | | | |
|---|---|---|---|---|---|---|---|---|
| | Immigrants | | Native Danes | | Immigrants | | Native Danes | |
| | Mean | Std. Dev. | Mean | Std. Dev. | Mean | Std. Dev | Mean | Std. Dev. |
| Employed | 0.599 | | 0.873 | | 0.451 | | 0.826 | |
| New diagnosis | 0.037 | | 0.030 | | 0.031 | | 0.026 | |
| Aged 25-29 | 0.140 | | 0.135 | | 0.187 | | 0.137 | |
| Aged 30-39 | 0.439 | | 0.315 | | 0.436 | | 0.312 | |
| Aged 40-49 | 0.319 | | 0.295 | | 0.276 | | 0.295 | |
| Aged 50-59 | 0.102 | | 0.255 | | 0.102 | | 0.257 | |
| Partnered | 0.728 | | 0.711 | | 0.766 | | 0.743 | |
| Child 0-6 years | 0.416 | | 0.224 | | 0.446 | | 0.249 | |
| Education. missing | 0.436 | | 0.011 | | 0.463 | | 0.008 | |
| No vocational or further education | 0.258 | | 0.314 | | 0.287 | | 0.340 | |
| Vocational education | 0.163 | | 0.434 | | 0.139 | | 0.361 | |
| Further education | 0.143 | | 0.241 | | 0.112 | | 0.291 | |
| 1998 | 0.102 | | 0.127 | | 0.094 | | 0.126 | |
| 1999 | 0.110 | | 0.127 | | 0.104 | | 0.127 | |
| 2000 | 0.117 | | 0.128 | | 0.113 | | 0.127 | |
| 2001 | 0.123 | | 0.127 | | 0.121 | | 0.127 | |
| 2002 | 0.129 | | 0.126 | | 0.130 | | 0.126 | |
| 2003 | 0.136 | | 0.126 | | 0.139 | | 0.125 | |
| 2004 | 0.143 | | 0.125 | | 0.148 | | 0.124 | |
| 2005 | 0.140 | | 0.115 | | 0.152 | | 0.119 | |
| Years since migration | 12.832 | 7.058 | | | 11.893 | 7.044 | | |
| Turkey | 0.181 | | | | 0.175 | | | |
| Former Yugoslavia | 0.164 | | | | 0.155 | | | |
| Somalia | 0.046 | | | | 0.042 | | | |
| Iraq | 0.082 | | | | 0.051 | | | |
| Iran | 0.083 | | | | 0.047 | | | |
| Lebanon | 0.073 | | | | 0.058 | | | |
| Pakistan | 0.051 | | | | 0.053 | | | |
| Rest of Europe | 0.015 | | | | 0.036 | | | |
| Rest of Africa | 0.094 | | | | 0.079 | | | |
| South America | 0.023 | | | | 0.037 | | | |
| Rest of Asia | 0.180 | | | | 0.260 | | | |
| Country of origin, missing | 0.007 | | | | 0.006 | | | |
| GP's referral rate at time t-1 | 0.130 | 0.046 | 0.140 | 0.051 | 0.130 | 0.045 | 0.139 | 0.050 |
| GP patients' log gross income at time t-1 | 11.399 | 0.268 | 11.507 | 0.200 | 11.375 | 0.281 | 11.497 | 0.207 |
| GP patients: share older than 50 at time t-1 | 0.229 | 0.083 | 0.271 | 0.076 | 0.224 | 0.084 | 0.263 | 0.078 |
| GP patients: share of non-Western immigrants at time t-1 | 0.187 | 0.150 | 0.076 | 0.077 | 0.193 | 0.158 | 0.081 | 0.084 |
| GP patients: share of women at time t-1 | 0.531 | 0.070 | 0.525 | 0.051 | 0.552 | 0.070 | 0.540 | 0.057 |
| # of observations | 358,134 | | 391,675 | | 375,026 | | 422,840 | |

Note. Means are taken over all persons-year observations. Standard deviations shown for continuous variables.

## 5. Results

We present results of the analyses of the effect of poor health (measured as an incidence of a new diagnosis) on the employment probability for immigrants and Danes based on a univariate probit specification (section 5.1) and a bivariate probit specification (section 5.2) respectively.

### *5.1 Univariate probit estimates*

The estimation results from the univariate probit models show that a new diagnosis affects the employment probability negatively, as expected, across all four groups (table 2). The impact is highly significant in all cases. The size of the marginal effects[15] shows, in accordance with our prior expectations, that a new diagnosis appears to have a larger impact on immigrants than on native Danes for both men and women, suggesting that health is a factor in the employment gap between immigrants and natives, especially for men. According to the estimates for men, a new diagnosis reduces the probability of being employed by 12.7 percentage points for immigrants compared to 7.0 percentage points for native Danes. The corresponding figures for women are 12.1 percentage points for immigrants and 10.5 percentage points for native Danes. Indeed, in terms of baseline probabilities, i.e. average employment probabilities, immigrants are more than twice as likely to be out of employment following a new diagnosis than native Danes (21% vs. 8% of baseline probability for men and 27% vs. 13% of baseline probability for women).

**Table 2**. **Pooled probit, marginal effect estimates of the impact of a new diagnosis on employment by ethnic group and gender. Robust standard errors in parentheses.**

| | **Men** | | **Women** | |
|---|---|---|---|---|
| | **Immigrants** | **Native Danes** | **Immigrants** | **Native Danes** |
| New diagnosis | -0.127*** | -0.070*** | -0.121*** | -0.105*** |
| | (0.005) | (0.003) | (0.005) | (0.004) |
| Log likelihood | -220317 | -128253 | -224101 | -177313 |
| # of individuals | 68,686 | 68,985 | 70,739 | 68,902 |
| # of observations | 358,134 | 391,675 | 375,026 | 422,840 |

Note: Standard errors in parentheses.* p<0.05. ** p<0.01. *** p<0.001. Additional controls include age dummies, family status, a dummy for children aged 0-6, educational category levels, and year dummies. In addition, years since immigration, years since migration squared and dummies for country of origin are included only for immigrants.

[15] Throughout the paper, we report the marginal effects of continuous variables at the means and of dummy variables for a change from 0 to 1.

Other factors also affect the employment probability (see table A.2 in the appendix). As expected, the probability of being employed is lower for 50-59 years old than for younger groups. Having a partner increases this probability, while having children aged 0-6 years lowers it except for native Danish men. Not surprisingly, the employment probability increases with the educational level. Finally, immigrants from South America are among those with the highest employment probability, whereas those from Lebanon are among the lowest.

### *5.2 Bivariate probit estimates*

Table 3 shows the results from the recursive bivariate probit models.[16] $\rho$ is positive for all four groups indicating that unexplained factors that affect health are positively correlated with unexplained factors affecting employment. For each model, we perform a Wald test of $\rho$=0; in every case we are able to reject the null hypothesis at the 0.1% level, suggesting that if our instrument is valid, the univariate probit results are in general biased and underestimate the negative impact of a new diagnosis on employment. Not surprisingly, the instrument affects the incidence of a new diagnosis positively for both immigrants and native Danes, i.e. the higher referral rate, the higher the probability of being diagnosed. Further, the impact is largest for immigrants, suggesting that GP behaviour is most important for this group for the probability of being diagnosed. A possible explanation could be that native Danes more largely receive diagnoses irrespective of the usual behaviour of their GP because they are more likely to insist on being hospitalized. Along the same line, lack of language skills among immigrants might make explaining their symptoms to their GP difficult, and therefore they are more affected by their GP's general referral behaviour.

Again, we find that the impact of a new diagnosis on the employment probability is negative for all four groups. As expected, we obtain larger marginal effects for new diagnoses from the bivariate probit than the univariate probit. The larger effects reflect the positive correlation between health and unexplained factors affecting employment. An additional explanation of the large effects is that we estimate the LATE while we obtain the average treatment effect among the diagnosed individuals from the univariate probit model. All estimates are highly significant. As for the univariate probit model, we find that the impact is larger for immigrant men than for native Danish men: a new diagnosis reduces the probability of being employed by about 46 percentage points for immigrants and 38 percentage points for native Danes. For women, however, we find nearly the

[16] The results for the full set of covariates for the first and second stage estimations appear in Table A.3a and A.3b in the Appendix.

same effect of a new diagnosis: the impact for immigrant women is about 41 percentage point compared to 39 percentage points for native Danish women. Hence, the difference in the results for the two groups of women becomes even smaller than the results of the univariate probit estimations, thereby underlining the importance of taking endogeniety into account. The bivariate probit estimates also show no gender differences in the impact of health for native Danes, while among immigrants the impact is largest on men.

**Table 3. Bivariate probit estimates of the impact of a new diagnosis on employment by ethnic group and gender. Standard errors in parentheses.**

| | Men | | Women | |
|---|---|---|---|---|
| | **Immigrants** | **Native Danes** | **Immigrants** | **Native Danes** |
| *Impact of a physical health shock on employment (marginal effects)* | | | | |
| New diagnosis | -0.458*** | -0.381*** | -0.408*** | -0.393*** |
| | (0.019) | (0.031) | (0.006) | (0.039) |
| *Impact of the instrument on a physical health shock (coefficients)* | | | | |
| GP’s referral rate t-1 | 0.583*** | 0.255** | 0.767*** | 0.351*** |
| | (0.113) | (0.093) | (0.122) | (0.095) |
| Log likelihood | -276,645 | -180,572 | -274,081 | -227,788 |
| Rho | 0.436 | 0.388 | 0.562 | 0.325 |
| | (0.034) | (0.031) | (0.023) | (0.040) |
| *Wald test of rho=0* | | | | |
| Chi(1) | 124 | 123 | 352 | 56 |
| Prob>chi2 | 0.000 | 0.000 | 0.000 | 0.000 |
| # of individuals | 68,686 | 68,985 | 70,739 | 68,902 |
| # of observations | 358,134 | 391,675 | 375,026 | 422,840 |

Standard errors in parentheses.* p<0.05. ** p<0.01. *** p<0.001. Additional controls include age dummies, family status, a dummy for children aged 0-6, educational category levels, and year dummies. Further, years since immigration, years since migration squared and dummies for country of origin are included only for immigrants. Finally, characteristics for GP’s patients with respect to average log gross income, share of patients above the age of 50, share of non-western immigrants and share of women are added as controls in the first stage. In all models the standard errors are adjusted for GP clustering. The coefficients for the full set of covariates for first and second stage of the model respectively appear in Tables A.3a and A.3b in the Appendix.

Even though the incidence of new diagnoses is quite low for all four groups, the impact of these diagnoses on the employment probability is in general larger than the effect of age, family factors and education, in particular for native Danes (see table A.3b in the appendix). For immigrants, the second largest effect arises from being in the age group 50-59 years, for whom the employment probability is reduced by 29 percentage points and 27 percentage points for men and women, respectively. For native Danes, the second most important factor, having a partner for men and further education for women, increases the employment probability by 17 percentage points.

Initially, we expected the impact of poor health to be greater for immigrants than for native Danes for both men and women following differential labour market status and discrimination. For women, this expectation is also a result of traditional views on gender roles among the immigrants. However, only the results for men meet these expectations. To better understand our findings, we therefore look at the importance of differences in the distribution of labour market status. These distributions (measured at time t-1) reveal great differences between immigrants and native Danes (table 4). Most pronounced is the high proportions of (especially female) immigrants out of the labour force and in unemployment (e.g. one of three immigrant women is not in the labour force compared to one out of ten native Danish women). Furthermore, for those employed, immigrants are underrepresented in management and in jobs requiring qualifications on high, medium or basic levels, and overrepresented in other (unspecified) jobs, i.e. at the bottom of the job hierarchy. Keeping in mind that our hypothesis about the influence of different distribution of labour market status concerns only individuals *in* the job market, the similar effects of poor health for the two groups of women might at least partly be due to differences for individuals out of the labour force with respect to the size of and the selection into this group.

**Table 4**. **Distribution of labour market status at time t-1 by ethnic group and gender.%.**

| | **Men** | | **Women** | |
|---|---|---|---|---|
| | **Immigrants** | **Native Danes** | **Immigrants** | **Native Danes** |
| Employed, management | 4.84 | 6.01 | 1.25 | 2.07 |
| Employed, high qualification level | 3.84 | 12.42 | 2.38 | 10.97 |
| Employed, medium qualification level | 3.00 | 12.15 | 3.37 | 19.48 |
| Employed, basic qualification level | 23.85 | 38.58 | 14.57 | 37.54 |
| Employed, other jobs[1)] | 11.10 | 9.15 | 11.59 | 5.61 |
| Employed, military | 0.06 | 1.11 | 0.00 | 0.07 |
| Employed, unspecified job | 9.62 | 7.96 | 7.13 | 6.44 |
| Unemployed | 22.08 | 5.18 | 24.86 | 7.52 |
| Out of labour force | 21.61 | 7.44 | 34.83 | 10.30 |
| All | 100.00 | 100.00 | 100.00 | 100.00 |
| # of observations | 358,134 | 391,675 | 375,026 | 422,840 |

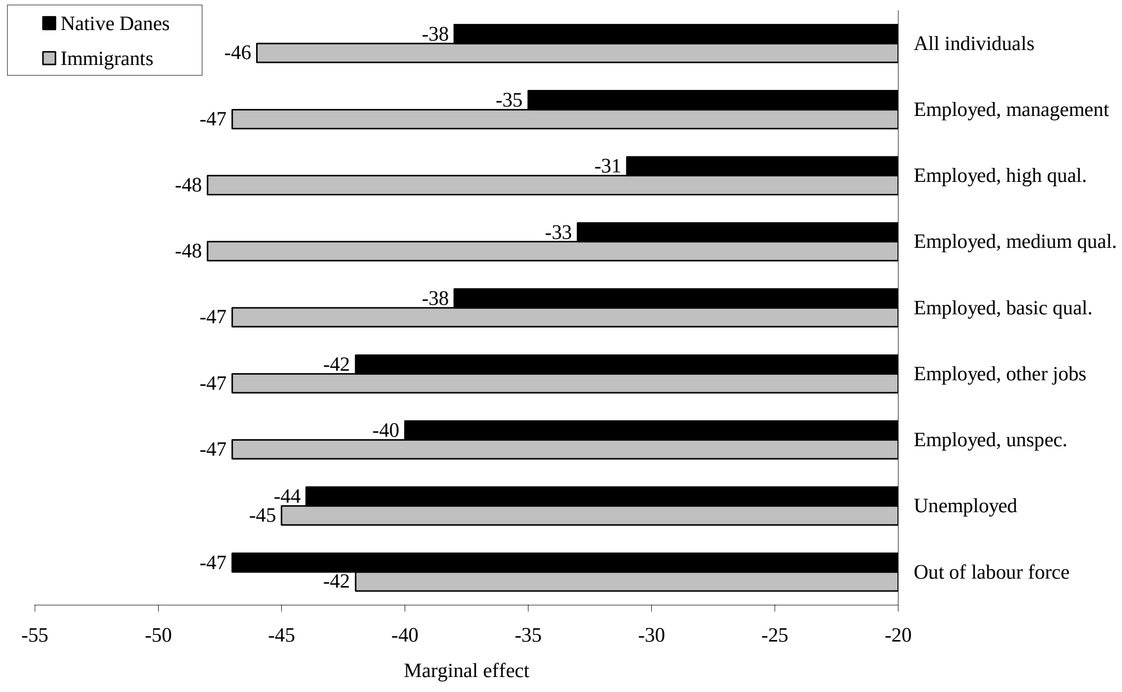
Note: Subdivision of job categories is based on the ISCO-88 code.
1) "Other jobs" mainly consists of jobs with simple tasks that only require a short instruction at the workplace, i.e. jobs at the lowest skill level.

To further explore the importance of differences in distribution of labour market status, we estimate marginal effects on samples subdivided by labour market status (figure 1 and 2).[17] For all job categories and irrespective of gender, we find a higher marginal effect of health on the employment

[17] These marginal effects are based on coefficients estimated for the whole sample (Table A.3b) and on mean values of the independent variables for each subsample. Although examining whether the health coefficient *differs* by labour market status calls for estimating the models separately for each labour market status category, the necessary attention on selection of labour market status is outside the scope of this paper.

probability for immigrants than for native Danes, while the opposite is found for those out of the labour force. A particularly large difference is found for women outside the labour force (marginal effects are 42 percentage points and 33 percentage points for immigrants and native Danes, respectively). Moreover, for the unemployed, a higher marginal effect is found for immigrant women (42 percentage points vs. 38 percentage points for native Danish women). More traditional views of gender roles might at least partly explain the higher prevalence of immigrant women out of employment (either permanently or for a long period) than native Danish women and thereby also help explain the smaller impact of poor health on employment prospects for these groups of immigrant women. Consequently, the similar impact of poor health for immigrant women and native Danish women in general (table 3) may be driven by a larger effect for employed immigrant women and a smaller impact for non-employment immigrant women, in particular for those out of the labour force.

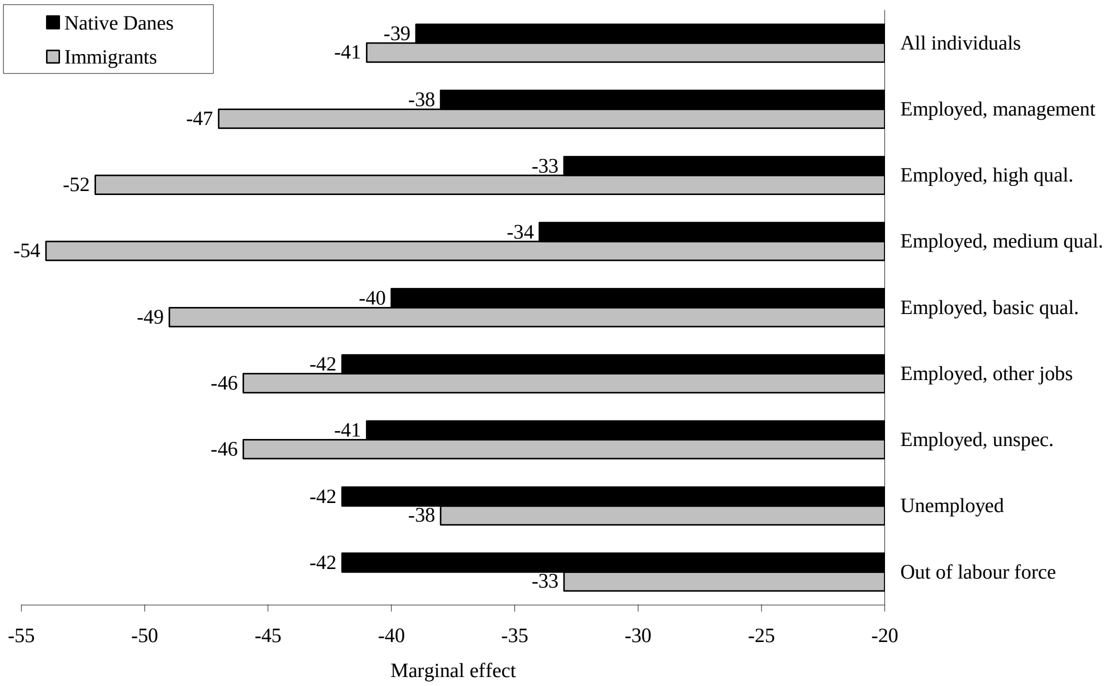
**Figure 1. Marginal effect estimates of the impact of a new diagnosis on employment for all and by labour market position at time t-1, men separately by ethnic group.**




Note: Marginal effects are not calculated for “employed, military” because of too few observations.

As expected, we find larger marginal effects for those in jobs at the top than those at the bottom of the job hierarchy (with management the sole exception), but only for native Danes. The absence of such a pattern for immigrants suggests that the differential distribution of job categories does not explain the larger impact of poor health for immigrant men compared to native Danish men. One potential explanation for this lack of differences in marginal effects by job categories for immigrant men is that these men are employed in more unstable jobs (including those requiring qualifications at the highest level), with a potential discrimination problem involved.

**Figure 2. Marginal effect estimates of the impact of a new diagnosis on employment for all and by labour market position at time t-1, women separately by ethnic group.**




Note: Marginal effects are not calculated for "employed, military" because of too few observations.

## 6. Conclusion

This paper examines whether the causal effect of health on employment status differs for immigrants and natives, comparing groups of non-Western immigrants and native Danes separately for men and women. In general, we expected the impact of poor health to be larger for immigrants than for native Danes due to differential distribution of labour market status and discrimination against immigrants and, especially for immigrant women, due to more traditional cultural views on gender roles.

Our health measure is an objective measure for poor health based on native Danish administrative register data. We identify poor health by using information about new hospital diagnoses for six widespread diseases (cardiovascular diseases, type 2 diabetes, preventable cancer, diabetes, chronic lung diseases, osteoporosis, and diseases of the musculoskeletal system), all of which are preventable to some extent. In general, the incidence of the selected diagnoses is quite low, less than 4%. However, irrespective of gender, immigrants are hospitalised as a result of the selected diseases to a significantly larger extent than native Danes, even though the immigrants are on average younger.

To make causal inferences, we apply a two-stage method, a bivariate probit model, where we use information about the GPs' rates of referral to hospitals as an instrument. In general, our results suggest that taking endogeneity of health into account is important when examining the impact of new diagnoses on employment and that univariate probit estimates are therefore biased. Using the GPs' rate of referral as an instrument for hospital diagnoses has proved to be a useful strategy – and applicable in future studies.

We find for both immigrants and native Danes that poor health has a negative impact on employment probability. However, the impact of health is larger for immigrants than for native Danes only for men (46 percentage points compared to 38 percentage points), while for women the effect is nearly the same for the two groups (41 and 39 percentage points respectively). These results show that among immigrants, the impact is larger for men than for women, whereas no gender difference appears for native Danes.

In general, the results suggest that poor health is a contributing factor to the immigrant-native employment gap for both men and women. For men, a higher prevalence of new diagnoses combined with a larger impact of these diagnoses on the employment probability contributes to explaining the employment gap. For women, the results suggest that only a higher prevalence of new diagnoses helps explain the gap. The impact of these diagnoses on the employment probability is in general larger than the effect of age, family factors and education, in particular for native Danes. However, keeping in mind the very low incidence of a 'new' diagnosis is important.

This paper also explores whether the differential distribution of labour market status helps explain our results. For women, this differential distribution appears important in explaining why we find (in contrast to our expectations) nearly the same effect for immigrants and native Danes. For men, however, the differential distribution appears less important for finding the expected larger impact for immigrants, while discrimination might be a more essential explanation. Nevertheless, a more profound examination of the importance of differential distribution of labour market status is necessary, with future research analysing potential heterogeneity in the impact of health by previous labour market status.

An important policy implication of our results is that an effort directed toward preventing cardiovascular diseases, type 2 diabetes, preventable cancer, diabetes, chronic lung diseases, osteoporosis and diseases of the musculoskeletal system is a useful approach to reducing the employment gap between immigrants and natives.

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## Table Appendix

**Table A.1. Sample selection**

| | Men | | Women | |
|---|---|---|---|---|
| | **Immigrants** | **Native Danes** | **Immigrants** | **Native Danes** |
| *Number of observations* | | | | |
| Full sample | 428,129 | 475,697 | 417,650 | 467,221 |
| Information on GP | 390,449 | 419,396 | 401,899 | 448,570 |
| Information on GP + No diagnoses at time t-1 | 371,660 | 403,275 | 386,175 | 433,597 |
| Information on GP + No diagnoses at time t-1 and time t-2 | 358,134 | 391,675 | 375,026 | 422,840 |
| *Percent* | | | | |
| Full sample | 100.0 | 100.0 | 100.0 | 100.0 |
| Information on GP | 91.2 | 88.2 | 96.2 | 96.0 |
| Information on GP and no diagnoses at time t-1 | 86.8 | 84.8 | 92.5 | 92.8 |
| Information on GP and no diagnoses at time t-1 and time t-2 | 83.7 | 82.3 | 89.8 | 90.5 |

**Table A.2. Pooled probit, marginal effect estimates of the impact of a new diagnosis on employment by ethnic group and gender. Marginal effects for the full set of covariates.**

| | Men | | | | Women | | | |
|---|---|---|---|---|---|---|---|---|
| | **Immigrants** | | **Native Danes** | | **Immigrants** | | **Native Danes** | |
| | Marg. eff.. | Std. err. | Marg. eff.. | Std. err. | Marg. eff.. | Std. err. | Marg. eff.. | Std. err. |
| New diagnosis | -0.127 | 0.005 *** | -0.070 | 0.003 *** | -0.121 | 0.005 *** | -0.105 | 0.004 *** |
| Aged 25-29 | 0.052 | 0.003 *** | 0.003 | 0.002 | 0.018 | 0.002 *** | -0.015 | 0.002 *** |
| Aged 40-49 | -0.110 | 0.002 *** | -0.014 | 0.001 *** | -0.101 | 0.002 *** | 0.005 | 0.002 ** |
| Aged 50-59 | -0.304 | 0.003 *** | -0.071 | 0.002 *** | -0.291 | 0.002 *** | -0.094 | 0.002 *** |
| Partnered | 0.126 | 0.002 *** | 0.171 | 0.002 *** | 0.094 | 0.002 *** | 0.116 | 0.002 *** |
| Child 0-6 years | -0.040 | 0.002 *** | 0.012 | 0.002 *** | -0.139 | 0.002 *** | -0.043 | 0.002 *** |
| Education, missing | 0.003 | 0.002 | -0.091 | 0.005 *** | -0.040 | 0.002 *** | -0.093 | 0.007 *** |
| Vocational education | 0.119 | 0.003 *** | 0.081 | 0.001 *** | 0.165 | 0.003 *** | 0.122 | 0.001 *** |
| Further education | 0.154 | 0.003 *** | 0.095 | 0.001 *** | 0.207 | 0.003 *** | 0.165 | 0.001 *** |
| Years since migration | 0.021 | 0.001 *** | | | 0.032 | 0.001 *** | | |
| Years since migration squared | 0.000 | 0.000 *** | | | -0.001 | 0.000 *** | | |
| Former Yugoslavia | -0.002 | 0.003 | | | 0.099 | 0.003 *** | | |
| Somalia | -0.268 | 0.005 *** | | | -0.221 | 0.004 *** | | |
| Iraq | -0.223 | 0.004 *** | | | -0.189 | 0.004 *** | | |
| Iran | -0.075 | 0.004 *** | | | 0.016 | 0.005 *** | | |
| Lebanon | -0.279 | 0.004 *** | | | -0.302 | 0.003 *** | | |
| Pakistan | 0.052 | 0.004 *** | | | -0.101 | 0.004 *** | | |
| Rest of Europe | -0.090 | 0.007 *** | | | 0.137 | 0.005 *** | | |
| Rest of Africa | 0.020 | 0.003 *** | | | 0.084 | 0.004 *** | | |
| South America | 0.077 | 0.006 *** | | | 0.210 | 0.005 *** | | |
| Rest of Asia | 0.023 | 0.003 *** | | | 0.189 | 0.003 *** | | |
| Country of origin. missing | -0.021 | 0.010 * | | | 0.111 | 0.011 *** | | |
| *Year dummies* | *yes* | | *yes* | | *yes* | | *yes* | |
| Log likelihood | -220317 | | -128253 | | -224101 | | -177313 | |
| Number of individuals | 68,686 | | 68,985 | | 70,739 | | 68,902 | |
| Number of observations | 358,134 | | 391,675 | | 375,026 | | 422,840 | |

Standard errors in parentheses.* p<0.05. ** p<0.01. *** p<0.001.

**Table A.3a. Bivariate probit estimates of the impact on a new diagnosis by ethnic group and gender. First stage estimates. Coefficients for the full set of covariates.**

| | Men | | | | Women | | | |
|---|---|---|---|---|---|---|---|---|
| | Immigrants | | Native Danes | | Immigrants | | Native Danes | |
| | Coef. | Std. Err. | Coef. | Std. Err. | Coef. | Std. Err. | Coef. | Std. Err. |
| GP's referral rate t-1 | 0.583 | 0.113 *** | 0.255 | 0.093 ** | 0.767 | 0.122 *** | 0.352 | 0.095 *** |
| Aged 25-29 | -0.096 | 0.014 *** | -0.093 | 0.015 *** | -0.182 | 0.013 *** | -0.107 | 0.017 *** |
| Aged 40-49 | 0.187 | 0.010 *** | 0.143 | 0.012 *** | 0.217 | 0.011 *** | 0.165 | 0.013 *** |
| Aged 50-59 | 0.382 | 0.014 *** | 0.347 | 0.013 *** | 0.425 | 0.014 *** | 0.386 | 0.013 *** |
| Partnered | 0.015 | 0.011 | -0.088 | 0.010 *** | -0.014 | 0.010 | -0.083 | 0.009 *** |
| Child 0-6 years | -0.023 | 0.010 * | -0.041 | 0.013 ** | -0.009 | 0.011 | -0.037 | 0.013 ** |
| Education. missing | 0.032 | 0.010 ** | 0.111 | 0.036 ** | 0.031 | 0.010 ** | -0.001 | 0.043 |
| Vocational education | -0.035 | 0.013 ** | -0.030 | 0.010 ** | -0.025 | 0.015 | -0.063 | 0.010 *** |
| Further education | -0.091 | 0.014 *** | -0.185 | 0.012 *** | -0.118 | 0.016 *** | -0.132 | 0.011 *** |
| Years since migration | 0.003 | 0.002 | | | -0.001 | 0.003 | | |
| Years since migration -squared | 0.000 | 0.000 | | | 0.000 | 0.000 | | |
| Former Yugoslavia | 0.010 | 0.016 | | | -0.062 | 0.017 *** | | |
| Somalia | -0.002 | 0.024 | | | -0.015 | 0.027 | | |
| Iraq | 0.102 | 0.018 *** | | | 0.050 | 0.022 * | | |
| Iran | 0.010 | 0.019 | | | -0.007 | 0.024 | | |
| Lebanon | 0.095 | 0.019 *** | | | -0.024 | 0.025 | | |
| Pakistan | 0.051 | 0.021 * | | | 0.042 | 0.020 * | | |
| Rest of Europe | 0.012 | 0.035 | | | -0.250 | 0.031 *** | | |
| Rest of Africa | 0.008 | 0.017 | | | -0.063 | 0.019 ** | | |
| South America | -0.149 | 0.032 *** | | | -0.150 | 0.027 *** | | |
| Rest of Asia | -0.080 | 0.016 *** | | | -0.219 | 0.016 *** | | |
| Country of origin. missing | -0.027 | 0.049 | | | -0.018 | 0.051 | | |
| GP patients' income | -0.073 | 0.027 ** | -0.155 | 0.030 *** | -0.053 | 0.031 | -0.181 | 0.032 *** |
| GP patients: share with age larger than 50 | -0.087 | 0.068 | 0.020 | 0.072 | -0.266 | 0.078 ** | -0.040 | 0.073 |
| GP patients: share of non-western immigrants | 0.053 | 0.054 | 0.239 | 0.066 *** | 0.172 | 0.059 ** | 0.055 | 0.066 |
| GP patients: share of women | 0.028 | 0.071 | 0.177 | 0.090 * | -0.031 | 0.078 | -0.324 | 0.091 *** |
| Constant | -1.153 | 0.333 ** | -0.286 | 0.358 | -1.347 | 0.374 *** | 0.213 | 0.384 |
| *Year dummies* | *yes* | | *yes* | | *yes* | | *yes* | |
| # of individuals | 68,686 | | 68,985 | | 70,739 | | 68,902 | |
| # of observations | 358,134 | | 375,026 | | 391,675 | | 422,840 | |

Standard errors in parentheses.* p<0.05. ** p<0.01. *** p<0.001

**Table A.3b. Bivariate probit estimates of the impact of a new diagnosis on employment by ethnic group and gender. Second stage estimates. Coefficients for the full set of covariates.**

| | Men | | | | | | | | women | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Immigrants** | | | | **Native Danes** | | | | **Immigrants** | | | | **Native Danes** | | | |
| | Coef | Std. Err. | | Marg. Eff. | Coef | Std. Err. | | Marg. Eff. | Coef | Std. Err. | | Marg. Eff. | Coef | Std. Err. | | Marg. Eff. |
| New diagnosis | -1.289 | 0.075 | *** | -0.458 | -1.259 | 0.079 | *** | -0.381 | -1.550 | 0.050 | *** | -0.408 | -1.151 | 0.100 | *** | -0.393 |
| Aged 25-29 | 0.131 | 0.010 | *** | 0.050 | 0.012 | 0.013 | | 0.002 | 0.032 | 0.009 | *** | 0.013 | -0.064 | 0.010 | *** | -0.016 |
| Aged 40-49 | -0.266 | 0.009 | *** | -0.104 | -0.073 | 0.012 | *** | -0.013 | -0.236 | 0.010 | *** | -0.092 | 0.025 | 0.011 | ** | 0.006 |
| Aged 50-59 | -0.734 | 0.016 | *** | -0.286 | -0.343 | 0.013 | *** | -0.067 | -0.770 | 0.016 | *** | -0.271 | -0.345 | 0.013 | *** | -0.089 |
| Partnered | 0.319 | 0.010 | *** | 0.125 | 0.792 | 0.011 | *** | 0.170 | 0.234 | 0.010 | *** | 0.091 | 0.437 | 0.009 | *** | 0.115 |
| Child 0-6 years | -0.103 | 0.008 | *** | -0.040 | 0.072 | 0.014 | *** | 0.012 | -0.348 | 0.008 | *** | -0.136 | -0.172 | 0.010 | *** | -0.043 |
| Education. missing | 0.011 | 0.009 | | 0.004 | -0.400 | 0.038 | *** | -0.088 | -0.095 | 0.009 | *** | -0.037 | -0.335 | 0.045 | *** | -0.093 |
| Vocational education | 0.313 | 0.012 | *** | 0.116 | 0.484 | 0.011 | *** | 0.082 | 0.406 | 0.012 | *** | 0.161 | 0.555 | 0.010 | *** | 0.122 |
| Further education | 0.411 | 0.013 | *** | 0.150 | 0.677 | 0.014 | *** | 0.095 | 0.505 | 0.014 | *** | 0.199 | 0.834 | 0.012 | *** | 0.165 |
| Years since migration | 0.054 | 0.002 | *** | 0.021 | | | | | 0.078 | 0.002 | *** | 0.031 | | | | |
| Years since migration squared | -0.001 | 0.000 | *** | 0.000 | | | | | -0.002 | 0.000 | *** | -0.001 | | | | |
| Former Yugoslavia | -0.005 | 0.017 | | -0.002 | | | | | 0.237 | 0.019 | *** | 0.094 | | | | |
| Somalia | -0.675 | 0.020 | *** | -0.264 | | | | | -0.597 | 0.026 | *** | -0.215 | | | | |
| Iraq | -0.549 | 0.020 | *** | -0.216 | | | | | -0.492 | 0.026 | *** | -0.181 | | | | |
| Iran | -0.188 | 0.018 | *** | -0.074 | | | | | 0.039 | 0.022 | * | 0.016 | | | | |
| Lebanon | -0.695 | 0.020 | *** | -0.272 | | | | | -0.879 | 0.028 | *** | -0.296 | | | | |
| Pakistan | 0.140 | 0.021 | *** | 0.053 | | | | | -0.246 | 0.022 | *** | -0.095 | | | | |
| Rest of Europe | -0.224 | 0.036 | *** | -0.088 | | | | | 0.320 | 0.025 | *** | 0.127 | | | | |
| Rest of Africa | 0.051 | 0.017 | *** | 0.019 | | | | | 0.200 | 0.021 | *** | 0.079 | | | | |
| South America | 0.195 | 0.029 | *** | 0.073 | | | | | 0.510 | 0.024 | *** | 0.201 | | | | |
| Rest of Asia | 0.055 | 0.016 | *** | 0.021 | | | | | 0.451 | 0.016 | *** | 0.178 | | | | |
| Country of origin. missing | -0.056 | 0.046 | | -0.022 | | | | | 0.271 | 0.046 | *** | 0.108 | | | | |
| Constant | -0.256 | 0.022 | *** | | 0.496 | 0.013 | *** | | -0.858 | 0.026 | *** | | 0.411 | 0.411 | *** | |
| *Year-dummies* | *Yes* | | | | *Yes* | | | | *Yes* | | | | *Yes* | | | |
| Rho | 0.436 | 0.034 | | | 0.388 | 0.031 | | | 0.562 | 0.023 | | | 0.325 | 0.040 | | |
| *Wald test of rho=0* | | | | | | | | | | | | | | | | |
| Chi2(1) | 124 | | | | 123 | | | | 352 | | | | 56 | | | |
| Prob>chi2 | 0.000 | | | | 0.000 | | | | 0.000 | | | | 0.000 | | | |
| Log likelihood | | -276,644 | | | | -180,572 | | | | -274,081 | | | | -227,788 | | |
| Number of individuals | | 68,686 | | | | 68,985 | | | | 70,739 | | | | 68,902 | | |
| Number of observations | | 358,134 | | | | 391,675 | | | | 375,026 | | | | 422,840 | | |

Standard errors in parentheses.* p<0.05. ** p<0.01. *** p<0.001.